II. Amendments to the Claims:

The following listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A gamma ray logging-while-drilling system comprising:

~~(a)~~ at least one gamma ray detector that measures a gamma ray energy spectrum;

wherein said system is configured to make ~~(b)~~ a first adjustment of gain of said detector ~~is made~~ using a measure of slope of a Compton scatter region of said spectrum.

2. (Currently Amended) The system of claim 1 wherein said system is configured to ~~a second adjustment of said gain is made by~~:

(a) ~~measuring~~ measure the location of an energy peak in said spectrum; and

(b) ~~adjusting~~ make a second adjustment of said gain so that said location corresponds to a standard location for said energy peak.

3. (Currently Amended) The system of claim 2 wherein said system is configured to ~~a third adjustment of said gain is made by~~:

(a) ~~measuring~~ measure locations of a plurality of energy peaks in said spectrum; and

(b) ~~adjusting~~ make a third adjustment of said gain so that each said location of each of said plurality of peaks corresponds to a standard location for that peak.

4. (Currently Amended) The system of claim 3 further comprising a processor cooperating with said at least one detector, wherein:

(a) said spectrum comprises gamma ray count rate recorded as a function of energy channel within said processor; and

(b) to make said first adjustment, ~~comprises adjusting, within~~ said processor [[,]] adjusts width of said energy channels as a function of said measure of slope.

5. (Currently Amended) The system of claim 4 wherein to make said second adjustment, ~~comprises adjusting, within~~ said processor [[,]] adjusts said width of said energy channels so that said location of said energy peak corresponds to a standard location for said energy peak.

6. (Currently Amended) The system of claim 5 further comprising an adjustable high voltage power supply cooperating with said processor and said at least one detector, wherein to make said third adjustment, ~~comprises adjusting~~ said adjustable high voltage power supply adjusts high voltage supplied to said at least one detector thereby setting said gain of said at least one detector to a standard gain.

7. (Original) The system of claim 1 further comprising a collar, wherein said at least one detector is disposed in a detector channel at the periphery of said collar.

8. (Original) The system of claim 1 further comprising a collar, wherein two or more detectors are each disposed within detector channels regularly spaced around the periphery of said collar.

9. (Currently Amended) The system of claim 6 wherein:

(a) said spectrum comprises gamma radiation from at least one naturally occurring radioactive element in formation penetrated by a borehole; and

(b) said processor combines said spectrum ~~is combined~~ with calibration constants ~~in said processor~~ using a predetermined relationship to obtain an elemental concentration of said at least one naturally occurring radioactive element.

10. (Original) The system of claim 9 wherein said at least one elemental concentration is measured as a function of depth within said borehole.

11. (Original) The system of claim 9 wherein said at least one elemental concentration is measured as a function of azimuthal sector around said borehole.

12. (Original) The system of claim 9 wherein said naturally occurring radioactive elements comprise potassium, uranium and thorium.

13. (Currently Amended) A gamma ray logging-while-drilling system comprising:

(a) ~~At~~ at least one gamma ray detector that measures a gamma ray energy spectrum;

(b) a calibration source disposed near or within said at least one detector and emitting calibration radiation; and

(c) dual gain circuitry comprising a standard amplification circuit and a high gain circuit;

wherein the system is configured to:

~~(d)~~ (i) branch and input said spectrum ~~is branched and input~~ into said dual gain circuitry to ~~producing~~ produce a standard gain spectrum and an amplified gain spectrum;

~~(e)~~ (ii) in said amplified gain spectrum, compare the observed position of a calibration peak from said calibration radiation ~~is compared~~ with a predetermined standard position for said calibration peak; and

~~(f)~~ (iii) ~~results of said comparison are used to~~ correct said standard gain spectrum to a standard detector gain using results of said comparison.

14. (Currently Amended) The system of claim 13 further comprising:

(a) an adjustable high voltage power supply cooperating with said at least one detector; and

(b) a processor cooperating with said dual gain circuitry and said adjustable high voltage power supply;

wherein

(i) said processor makes said comparison ~~is made in said processor~~,

(ii) said processor generates a calibration signal indicative of said comparison and inputs ~~the~~ said calibration signal to said adjustable high voltage power supply, and

(iii) said adjustable high voltage power supply adjusts high voltage supplied to said at least one detector ~~by said adjustable high voltage power supply is adjusted~~ in relation to said calibration signal thereby correcting said standard gain spectrum to said standard detector gain.

15. (Original) The system of claim 13 further comprising a collar, wherein said at least one detector is disposed in a detector channel at the periphery of said collar.

16. (Original) The system of claim 13 further comprising a collar, wherein two or more detectors are each disposed within detector channels that are angularly spaced around the periphery of said collar.

17. (Currently Amended) The system of claim 14 wherein:

(a) said spectrum comprises gamma radiation from at least one naturally occurring radioactive element in formation penetrated by a borehole; and

(b) said processor combines said spectrum ~~is combined~~ with calibration constants ~~in said processor~~ using a predetermined relationship to obtain an elemental concentration of said at least one naturally occurring radioactive element.

18. (Original) The system of claim 17 wherein said at least one elemental concentration is obtained as a function of depth within said borehole.

19. (Original) The system of claim 17 wherein said at least one elemental concentration is obtained as a function of azimuthal sector around said borehole.

20. (Original) The system of claim 17 wherein said spectrum comprises gamma radiation from potassium, uranium and thorium.

21. (Original) A method for measuring gamma radiation while drilling a borehole, the method comprising the steps of:

(a) measuring a gamma ray spectrum with at least one gamma ray detector; and

(b) making a first adjustment of gain of said detector using a measure of slope of a Compton scatter region of said spectrum.

22. (Original) The method of claim 21 comprising the additional step of making a second adjustment of said gain by:

(a) measuring the location of an energy peak in said spectrum; and

(b) adjusting said gain so that said location corresponds to a standard location for said energy peak.

23. (Original) The method of claim 22 comprising the additional step of making a third adjustment of said gain by:

(a) measuring locations of a plurality of energy peaks in said spectrum; and

(b) adjusting said gain so that each said location of each of said plurality of peaks corresponds to a standard location for that peak.

24. (Original) The method of claim 23 comprising the additional steps of:

(a) operationally connecting a processor to said at least one detector;

(b) obtaining with said processor said spectrum comprising gamma ray count rate as a function of energy channels; and

(c) making said first adjustment of said gain, within said processor, by adjusting width of said energy channels as a function of said measure of slope.

25. (Original) The method of claim 24 comprising the additional step of making said second adjustment of said gain, within said processor, by adjusting said width of said energy channels.

26. (Original) The method of claim 25 comprising the additional steps of

(a) providing an adjustable high voltage power supply which cooperates with said processor and with said at least one detector; and

(b) making said third adjustment of said gain by adjusting said adjustable high voltage power supply thereby setting said gain of said at least one detector to a standard gain.

27. (Original) The method of claim 21 comprising the additional step of disposing said at least one detector in a detector channel at the periphery of a collar.

28. (Original) The method of claim 21 comprising the additional steps of disposing two or more detectors each within detector channels that are angularly spaced around the periphery of a collar.

29. (Original) The method of claim 26 comprising the additional steps of

(a) measuring said spectrum comprising gamma radiation from at least one naturally occurring radioactive element in formation penetrated by said borehole; and

(b) combining said spectrum with calibration constants in said processor using a predetermined relationship to obtain an elemental concentration of said at least one naturally occurring radioactive element.

30. (Original) The method of claim 29 comprising the additional step of obtaining said at least one elemental concentration as a function of depth within said borehole.

31. (Original) The method of claim 29 comprising the additional step of obtaining said at least one elemental concentration as a function of azimuthal sector around said borehole.

32. (Original) The method of claim 29 wherein said spectrum comprises gamma radiation from potassium, uranium and thorium.

33. (Original) A method for measuring gamma radiation while drilling a borehole, the method comprising the steps of:

(a) measuring a gamma ray energy spectrum with least one gamma ray detector;

(b) disposing a calibration source near or within said at least one detector;

(c) measuring within said gamma ray energy spectrum calibration radiation emitted by said calibration source;

(d) providing a dual gain circuitry comprising a standard amplification circuit and a high gain circuit;

(e) branching said spectrum into said dual gain circuitry thereby producing a standard gain spectrum and an amplified gain spectrum;

(f) in said amplified gain spectrum, observing a position of a calibration peak resulting from said calibration radiation;

(g) comparing said observed position with a predetermined standard position for said calibration peak; and

(h) using said comparison to correct said standard gain spectrum to a standard detector gain.

34. (Original) The method of claim 33 further comprising the additional steps of:

(a) providing an adjustable high voltage power supply which cooperates with said at least one detector; and

(b) providing a processor that cooperates with said dual gain circuitry and said adjustable high voltage power supply;

(c) making said comparison in said processor;

(d) generating a calibration signal indicative of said comparison;

(e) imputing said calibration signal to said adjustable high voltage power supply; and

(f) adjusting high voltage supplied to said at least one detector by said adjustable high voltage power supply in relation to said calibration signal thereby correcting said standard gain spectrum to said standard detector gain.

35. (Original) The method of claim 33 comprising the additional step of disposing said at least one detector in a detector channel at the periphery of a collar.

36. (Original) The method of claim 33 comprising the additional step of disposing two or more detectors each within detector channels that angularly spaced around the periphery of a collar.

37. (Original) The method of claim 34 comprising the additional steps of:

(a) measuring said spectrum comprising gamma radiation from at least one naturally occurring radioactive element in formation penetrated by a borehole; and

(b) combining said spectrum with calibration constants in said processor using a predetermined relationship to obtain an elemental concentration of said at least one naturally occurring radioactive element.

38. (Original) The method of claim 37 comprising the additional step of obtaining said at least one elemental concentration as a function of depth within said borehole.

39. (Original) The method of claim 37 comprising the additional step of obtaining said at least one elemental concentration as a function of azimuthal sector around said borehole.

40. (Currently Amended) The method of claim 37 wherein said spectrum comprises gamma radiation from potassium, uranium and thorium.

41. (Currently Amended) A gamma radiation logging-while-drilling system for measuring elemental concentration of at least one naturally occurring radioactive element in a formation penetrated by a borehole, the system comprising:

(a) at least one gamma ray detector; and

(b) a calibration source in the vicinity of said at least one gamma ray detector;

wherein ~~(c)~~ said gamma ray detector measures a gamma ray spectrum comprising a first component from said at least one naturally occurring radioactive element and a second component from said calibration source; and

wherein said system is configured to:

~~(d)~~ determine a first detector gain correction ~~is determined~~ from features of said first component;

~~(e)~~ determine a second detector gain correction ~~is determined~~ from said second component; and

~~(f)~~ combine said first and said second gain corrections ~~are combined~~ to correct for gain shifts in said gamma ray detector.

42. (Currently Amended) The system of claim 41 further comprising a processor, wherein said processor combines features of said first component ~~are combined~~ with calibration constants ~~in said processor~~ using a predetermined relationship to obtain said elemental concentration of said at least one naturally occurring radioactive element.

43. (Original) The system of claim 42 wherein said at least one elemental concentration is obtained as a function of depth within said borehole.

44. (Original) The system of claim 42 wherein said at least one elemental concentration is obtained as a function of azimuthal sector around said borehole.

45. (Original) A method for measuring, while drilling a borehole, elemental concentration of at least one naturally occurring radioactive element contained in formation penetrated by said borehole, the method comprising the steps of:

(a) conveying at least one gamma ray detector within said borehole;

(b) disposing a calibration source in the vicinity of said at least one gamma ray detector;

(c) measuring, with said at least one gamma ray detector, a gamma ray spectrum comprising a first component from said at least one naturally occurring radioactive element and a second component from said calibration source;

(d) determining a first detector gain correction from features of said first component;

(e) determining a second detector gain correction from said second component; and

(f) combining said first and said second detector gain corrections to correct for gain shifts in said at least one gamma ray detector.

46. (Original) The method of claim 45 comprising the additional step of combining features of said first component with calibration constants using a predetermined relationship to obtain said elemental concentration of said at least one naturally occurring radioactive element.

47. (Original) The method of claim 46 comprising the additional step of obtaining said at least one elemental concentration as a function of depth within said borehole.

48. (Original) The method of claim 46 comprising the additional step of obtaining said at least one elemental concentration as a function of azimuthal sector around said borehole.

49. (Currently Amended) A gamma ray logging-while-drilling system comprising:

(a) at least one gamma ray detector; and

(b) a processor operationally connected to said at least one detector;

wherein ~~(c)~~ said gamma ray detector cooperates with said processor to yield a spectrum encompassing a range of about 3 MeV and comprising gamma ray count rate recorded as a function of energy channel.

50. (Original) The system of claim 49 further comprising a collar, wherein said at least one detector is disposed in a detector channel at the periphery of said collar.

51. (Original) The system of claim 49 further comprising a collar, wherein two or more detectors are each disposed within detector channels angularly spaced around the periphery of said collar.

52. (Currently Amended) The system of claim 49 wherein:

(a) said spectrum comprises gamma radiation from at least one naturally occurring radioactive element in formation penetrated by a borehole; and

(b) said processor combines said spectrum ~~is combined~~ with calibration constants ~~in said processor~~ using a predetermined relationship to obtain an elemental concentration of said at least one naturally occurring radioactive element.

53. (Previously Presented) A method for measuring gamma radiation while drilling a borehole, the method comprising the steps of:

(a) disposing at least one gamma ray detector within said borehole;

(b) operationally connecting a processor to said at least one detector; and

(c) with said processor cooperating with said at least one gamma ray detector, measuring an energy spectrum of said gamma radiation encompassing a range of about 3 MeV and comprising gamma ray count rate recorded as a function of energy channel.

54. (Original) The method of claim 53 comprising the additional step of disposing said at least one detector in a detector channel at the periphery of a collar.

55. (Original) The method of claim 53 comprising the additional step of disposing two or more detectors within detector channels angularly spaced around the periphery of a collar.

56. (Original) The method of claim 53 wherein:

(a) said spectrum comprises gamma radiation from at least one naturally occurring radioactive element in formation penetrated by a borehole; and

(b) said spectrum is combined with calibration constants in said processor using a predetermined relationship to obtain an elemental concentration of said at least one naturally occurring radioactive element.